

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

|                                 |                             |
|---------------------------------|-----------------------------|
| In re Patent Application of:    | ) Confirmation No.: 5132    |
| Koji <b>ABE</b> , <i>et al.</i> | ) Group Art Unit: 1726      |
| Application No.: 10/564,852     | ) Examiner: Laura S. Weiner |
| Filed: January 17, 2006         | )                           |
| For: NON-AQUEOUS ELECTROLYTIC   | )                           |
| SOLUTION FOR LITHIUM            | )                           |
| SECONDARY BATTERY AND           | )                           |
| LITHIUM SECONDARY BATTERY       |                             |
| USING THE SAME                  |                             |

**APPEAL BRIEF**

**Mail Stop Appeal Brief - Patents**  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 35 U.S.C. § 134 and 37 C.F.R. § 41.37, Appellants submit this Appeal Brief in support for the Notice of Appeal filed February 28, 2011, to appeal the Examiner's final rejections in the Final Office Action dated November 26, 2010.

The \$540.00 fee for filing a brief in support of an appeal is submitted herewith. If any additional fees are required or if the enclosed payment is insufficient, the Commissioner is hereby authorized to charge the required fees to Deposit Account No. 19-2380.

**Except** for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 19-2380. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

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**I. REAL PARTY IN INTEREST**

Ube Industries., Ltd. is the assignee and real party in interest.

**II. RELATED APPEALS AND INTERFERENCES**

Co-pending Application No. 10/584,266 is currently under appeal awaiting decision by the Board of Patent Appeals and Interferences as Appeal No. 2010-007878. No Decision has yet been issued.

**III. STATUS OF THE CLAIMS**

Claims 13-15 and 18-19 have been finally rejected and are on appeal, with claims 16 and 17 withdrawn from consideration.

**IV. STATUS OF THE AMENDMENTS**

No claim amendments have been made subsequent to the Final Office Action of November 26, 2010.

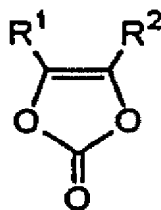
Applicants have attempted to obtain acceptance of a Terminal Disclaimer originally filed on November 1, 2010 with respect to Application No. 10/584,266. A further Terminal Disclaimer was filed on February 28, 2011, and then a Supplemental Response was filed on March 18, 2011 based on an objection to the Declaration/Oath.

Applicants filed simultaneous with the instant Appeal Brief a further Supplemental Response and Terminal Disclaimer with respect to Application No. 10/584,266 to attempt to have disclaimer accepted to thereby reduce the issues on appeal.

**V. SUMMARY OF CLAIMED SUBJECT MATTER**

This Appeal is taken from claims 13-15 and 18-19, of which claim 13 is independent.

Independent claim 13 relates to a lithium secondary battery (Specification, *e.g.*, p. 4, line 12) comprising a positive electrode, a negative electrode (Specification, *e.g.*, p. 3, line 28) and a non-aqueous electrolytic solution (Specification, *e.g.*, p. 4, line 14) wherein the positive electrode comprises a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm<sup>3</sup> provided on aluminum foil (Specification, *e.g.*, p. 32, lines 33-35), said positive electrode composition layer comprising a complex metal oxide of lithium (Specification, *e.g.*, p. 35, line 16), wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm<sup>3</sup> provided on copper foil (Specification, *e.g.*, p. 33, lines 4-6), said negative electrode composition layer comprising a material capable of absorbing and releasing lithium (Specification, *e.g.*, p. 31, line 3-4), and wherein the non-aqueous electrolytic solution comprises an electrolyte salt (Specification, *e.g.*, p. 4, line 3-4) and a non-aqueous solvent comprising a chain carbonate (Specification, *e.g.*, p. 26, line 13) and a cyclic carbonate (Specification, *e.g.*, p. 26, line 9) selected from the group consisting of ethylene carbonate and propylene carbonate (Specification, *e.g.* p.26, line 7-11), wherein the non-aqueous electrolytic solution contains a vinylene carbonate compound of formula (I) (Specification, *e.g.*, p. 4, line 14) in an amount of 0.05 to 5 wt.% and an alkyne compound of formula (VI) in an amount of 0.1 to 3 wt.%:

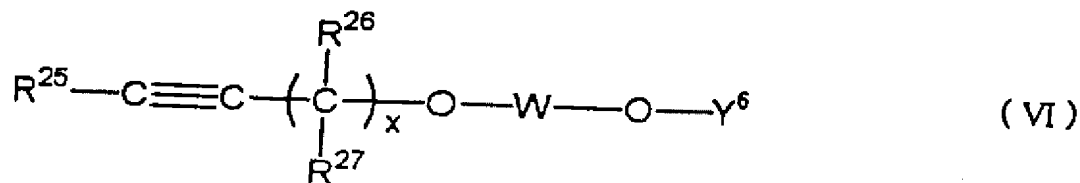


(I)

(Specification, *e.g.*, p. 4, line 19)



in which each of  $R^1$  and  $R^2$  independently is a hydrogen atom or an alkyl group having 1 to 4 carbon atoms:



(Specification, *e.g.*, p. 7, line 4)

in which each of  $R^{25}$  to  $R^{27}$  independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms, or  $R^{26}$  and  $R^{27}$  are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms;  $x$  is 1 or 2;  $W$  is sulfinyl or oxalyl; and  $Y^6$  is an alkyl group having 1 to 12 carbon atoms, an alkenyl group having 2 to 12 carbon atoms, an alkynyl group having 2 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms (Specification, *e.g.*, p. 7, line 5-18).

**VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

The grounds of rejection to be reviewed on appeal are:

(A) Whether claims 13-15 and 18-19 are properly rejected under 35 U.S.C. §103(a) over Hamamoto et al. (JP 2002-124297, translation), in view of Hamamoto et al. (US 2002/0122988)/(US 6,866,966) or Hamamoto et al. (6,927,001), and further in view of Koshina (JP 2003-142075, abstract).

(B) Whether claims 13-15 and 16-19 should remain provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6 and 8 of co-pending Application No. 10/584,266, in view of Koshina, and, in view of filing of the Terminal Disclaimer.

## VII. ARGUMENTS

### A. Rejection of Claims 13-15 and 18-19 Under 35 U.S.C. §103(a)

Hamamoto et al. (JP Patent No. 2002-124297, translation, hereinafter “Hamamoto ‘297”) and Hamamoto et al. (U.S. Patent Publication No. 2002/0122988, hereinafter, “Hamamoto ‘988”)/(U.S. Patent No. 6,866,966 hereinafter, “Hamamoto ‘966”) or Hamamoto et al. (U.S. Patent No. 6,927,001, hereinafter, “Hamamoto ‘001”) or Koshina (U.S. Patent No. 6,872,156, hereinafter “Koshina ‘156”), taken alone or in combination fail to disclose, suggest or render obvious the invention recited in independent claim 13. As a result, the rejection of claims 13-15, and 18-19 should be reversed.

In accordance with the M.P.E.P. § 2143.03, to establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 409 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). “All words in a claim must be considered in judging the patentability of that claim against the prior art.” *In re Wilson*, 424 F.2d 1382, 1385, 165 U.S.P.Q. 196 (CCPA 1970). Applicants contend that the Examiner has failed to establish a *prima facie* case of obviousness in this case, because each aspect of the recited invention is not taught or suggested by the cited art.

As is clear from the generic claim (claim 13) and the description of the originally filed specification on page 2, line 33 to page 4, line 7, the claims are directed to an improved lithium secondary battery employing a positive electrode having a high density and a negative electrode having a high density. The lithium secondary battery employing a positive electrode having a high density and a negative electrode having a high density is disclosed in JP 2003-142075 A. JP 2003-142075A describes the positive electrode having a high density and a negative electrode having a high density in detail but does not give detailed descriptions concerning a non-aqueous electrolytic solution employed in the battery except in the description of the working examples. Throughout the working examples, an electrolytic solution

employing a non-aqueous solvent comprising a combination of ethylene carbonate (EC) and ethyl methyl carbonate (EMC) in a volume ratio of 1:3 is used.

According to studies performed by Applicants of the subject application, it was found that the electrolytic solution employing a non-aqueous solvent comprising the combination of EC and EMC does not provide to the lithium secondary battery employing the positive/negative electrodes having a high density enough battery performance, particularly in connection with discharge capacity retention (i.e., cycle characteristics) after the increased charge-discharge cycles such as 300 cycle charge-discharge procedures under severe temperature conditions such as at 60°C.

The positive/negative electrodes having a high density are composed of dense active materials (i.e., electrode active particles). See the attached Illustration A-1. The poor discharge capacity retention observed in the lithium secondary battery employing the positive/negative electrodes having a high density is considered to arise from locally occurring decomposition of the electrolytic solution and formation of vacant spaces in the electrolytic solution area (i.e., electrolyte area) after the repeated charge/discharge procedures. If the vacant spaces are formed in the electrolytic solution area even locally, the movement of Li ion in the battery during battery charging and discharge is disturbed in the case that the electrodes having a high density are employed, whereby lowering the discharge capacity retention (see Illustration A-2). If the lithium secondary battery is a conventional battery employing positive/negative electrodes having a relatively low density (see Illustration B-1), however, the pathway for the Li ion movement is maintained even if the vacant spaces are formed in the electrolytic solution area (see Illustration B-2). Thus, the locally occurring decomposition of the electrolytic solution is troublesome, particularly in the case that the lithium secondary battery employs the positive/negative electrodes having a high density.

As is described on page 3, lines 15-19 of the originally filed specification, it was known that the cycle characteristics can be improved by adding a vinylene carbonate compound or an alkyne compound to a non-aqueous electrolytic solution of a lithium secondary battery. However, according to findings by Applicants, the known electrolytic solution comprising a non-aqueous solvent and vinylene carbonate or an alkyne compound still cannot provide a lithium secondary battery employing positive/negative electrodes having a high density enough discharge capacity retention performance after the increased charge-discharge cycles such as 300 cycle charge-discharge procedures. Therefore, Applicants continued the study to provide an electrolytic solution favorably employable in the lithium secondary battery employing positive/negative electrodes having a high density to provide to the battery enough discharge capacity retention performance after the increased charge-discharge cycles such as 300 cycle charge-discharge procedures.

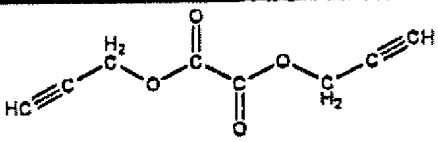
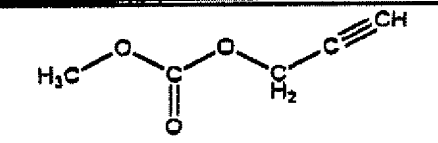
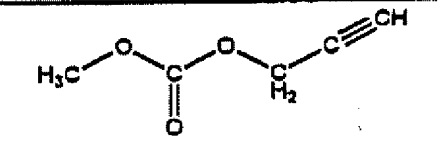
Applicants discovered that the incorporation of a small amount (i.e., 0.1 to 3 wt.%) of the specific alkyne compound of formula (VI) and a small amount (i.e., 0.05 to 5 wt.%) of vinylene carbonate in combination into the electrolytic solution is effective to provide to the lithium secondary battery employing the positive/negative electrodes having a high density a high discharge capacity retention performance after the increased charge-discharge cycles such as 300 cycle charge-discharge procedures under severe temperature conditions such as at 60 °C.

*Hamamoto et al. (JP 2002-124297, '297)* is relied upon for allegedly describing incorporation of a small amount of the alkyne compound of formula (VI) into the electrolytic solution for the use of a lithium secondary battery of the conventional type and further describes possible use of cyclic carbonates such as ethylene carbonate (EC), propylene carbonate (PC), butylene carbonate (BC) and vinylene carbonate (VC) as non-aqueous solvents. However, *Hamamoto et al. '297 does not* teach the amount of cyclic carbonates, specifically of vinylene carbonate present.

As for the amount of vinylene carbonate in an electrolyte solution, the Examiner relies on Hamamoto '988 or Hamamoto et al. '001, but these references are also not sufficient to reach the presently claimed invention. Specifically, *Hamamoto et al. (US 2002/1022988, '988)* allegedly describes a non-aqueous solvent composition containing 2% of vinylene carbonate and incorporation of 2 wt % of an alkyne compound (methyl 2-propynyl carbonate), but merely teaches a combination of 2 wt.% of vinylene carbonate and methyl 2-propynyl carbonate. It does not, however, teach the combination of 2 wt% of vinylene carbonate and the oxalyl group-containing alkyne compound belonging to Applicants' recited alkyne compound of formula (VI). It is clear that the 2-propynyl carbonate of Hamamoto '988 *is not* the oxalyl group-containing alkyne compound of the currently recited invention.

*Hamamoto et al (US 6,927,001, '001)* describes a non-aqueous solvent composition containing 1.5 wt % of vinylene carbonate and incorporation of 1.5 wt % of an alkyne compound (MPGC, i.e., methyl propargyl carbonate) which apparently differs from the alkyne compound defined in instant claim 13. Hamamoto '001 appears to teach the use of vinylene carbonate in an amount of 1.5 wt.%. However, Hamamoto '001 merely teaches a combination of 1.5 wt.% of vinylene carbonate and methyl propargyl carbonate (which is the same as the above-mentioned methyl 2-propynyl carbonate) and *does not* teach the combination of 1.5 wt% of vinylene carbonate and the oxalyl group-containing alkyne compound belonging to Applicants' recited alkyne compound of formula (VI).

In order to assist in demonstrating the difference between the methyl 2-propynyl carbonate (or methyl propargyl carbonate) and the recited oxalyl group-containing alkyne compound, particularly, di(2-propynyl)oxalate, Applicants illustrate below the chemical formulas of these compounds.

|                             |  |
|-----------------------------|--|
| di(2-propynyl)oxalate       |  |
| methyl 2-propynyl-carbonate |  |
| methyl propargyl carbonate  |  |

The invention of Hamamoto '297 is directed simply to the use of the alkyne compound (VI) in a non-aqueous electrolytic solution for lithium secondary batteries. Although Hamamoto '297 describes possible use of vinylene carbonate as one component of the non-aqueous solvent, there is given no teaching that the use of vinylene carbonate in combination with the alkyne compound (VI) brings about certain favorable effects in comparison with the use of the alkyne compound (VI) in combination with other non-aqueous solvents. No working examples are presented for the use of the combination of the alkyne compound (VI) and vinylene carbonate. The discharge capacity retentions of lithium secondary batteries are evaluated in the form of a coin battery in relatively mild conditions such as the 50 cycle charge-discharge procedures at room temperature (20°C) and at 0.8 mA.

In contrast, in Applicants' claimed invention, a lithium secondary battery incorporates Applicants' finding that the lithium secondary battery employing a non-aqueous electrolytic solution containing the combination of a small amount of a vinylene carbonate of formula (I) and a small amount of an alkyne compound of formula (VI) provides a prominently improved discharge capacity retention (i.e., remaining rate of discharging capacity) after repeated charge-discharge procedures such as 300 cycle charge-discharge procedures at such a high temperature as 60°C and at such a high charge-discharge current as 2.2A (1C) when the above-mentioned electrolytic solution is employed in a cylindrical battery in combination

with the combination of the positive electrode and negative electrode both having the defined high density.

The above-mentioned finding is experimentally shown in the originally filed specification. Specifically, Example 13 describes a lithium secondary battery employing an electrolytic solution containing a combination of 0.2 wt % of di(2-propynyl) oxalate and 3 wt % of vinylene carbonate (see Example 1) which shows such a high discharge capacity retention after 300 cycles as 81.7%. This high discharge capacity retention should be compared with the discharge capacity retention of 64.3% which is seen in the lithium secondary battery of Comparison Example 1 (containing 3 wt % of vinylene carbonate and no alkyne compound) in Table 1, as well as provided in the results of additional experiments provided in the Declaration Pursuant to Rule 132 filed November 1, 2010 (attached)e. The experiments contained in said Declaration provide further evidence of the unexpected results of the presently claimed invention.

The Examiner erroneously states that “the Declaration filed November 1, 2010 does not overcome the rejection because Hamamoto et al. ('297) teaches [...] an electrolyte comprising EC, PC, VC, etc in an electrolyte comprising an alkyne compound having formula (I) in which the compound can be present 0.1-10 wt% and teaching where the Y component can be an alkyl group having 1-12 carbon atoms, an alkynyl group, etc. and teaches that the Formula has the structure  $R_1-C\equiv C-CR_2R_3)_n-O-X-O-Y$  where X can be  $O=C-C=O$  or  $O=S=O$  or  $S=O$  and teaches that the solvent can include EC, PV, VC, etc. and it is known to use vinylene carbonate in the ration EC:PC:VC:DEC=25:8:2:65 as taught by Hamamoto et al ('988) or use vinylene carbonate in the ration EC/PC/DEC and additives comprising 1.5 wt% VC and 1.5 wt% MPGC as taught by Hamamoto et al. ('001) because Hamamoto et al ('088) and Hamamoto et al. ('001) teach that both vinylene carbonate is known to be used in a battery comprising a solvent comprising PC and DEC using a



compound having the structure  $R_1-C\equiv C-CR_2R_3)_n-O-X-O-Y$  and having the same cathode and the same anode. However, as previously explained, the alleged combination of Hamamoto et al. ('297) and Hamamoto et al. ('988)/Hamamoto et al. ('001) does not teach or suggest the alkyne compound described in claim 13. Consequently, the Examiner's position is unwarranted.

Koshina gives neither teaching nor suggestion concerning the electrolytic solution specified in the currently pending claims, and, thus, fails to overcome the deficiencies of the Hamamoto et al. references.

Thus, neither Hamamoto nor Koshina, taken either alone or in combination, anticipate or render obvious each and every feature recited in independent claim 13. It would not have been obvious to combine the teachings of Hamamoto '297, Hamamoto '988, Hamamoto '001 or Koshina to develop the claimed process." Applicants disagree for at least the reasons set forth above. Thus, Applicants respectfully assert that the Office Action fails to establish a *prima facie* case of obviousness.

B. Rejection of Claims 13-15, 18-19 on the ground of nonstatutory obviousness-type double patenting

The Terminal Disclaimer filed on November 1, 2010 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of 10/584,266 was reviewed and found unacceptable by the Examiner. A corrected Terminal Disclaimer was filed on February 28, 2011, but this too was not considered acceptable by the Examiner. Applicants attempted to overcome this objection on March 18, 2011 and again on July 28, 2011 by rendering the Declaration/Oath acceptable for purposes of filing the Terminal Disclaimer. As a result, the provisional refusal based on co-pending Application No. 10/584,266 should now be rendered moot.

C. Conclusion

Accordingly, for at least the above reasons, Appellants respectfully submit that the rejection of claims 13-15 and 18-19 35 U.S.C. § 103(a) should be overturned, and an indication of immediate allowability is respectfully requested.

Respectfully submitted,

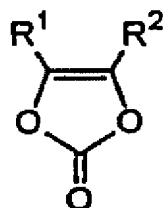
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**IX. CLAIMS APPENDIX**

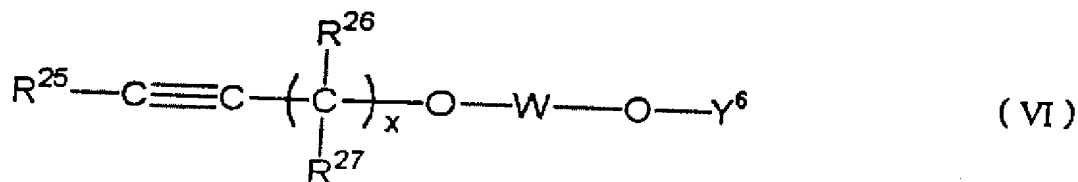
1-12. (Canceled)

13. (Previously Presented) A lithium secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolytic solution, wherein the positive electrode comprises a positive electrode composition layer having a density in the range of 3.2 to 4.0 g/cm<sup>3</sup> provided on aluminum foil, said positive electrode composition layer comprising a complex metal oxide of lithium, wherein the negative electrode comprises a negative electrode composition layer having a density in the range of 1.3 to 2.0 g/cm<sup>3</sup> provided on copper foil, said negative electrode composition layer comprising a material capable of absorbing and releasing lithium, and wherein the non-aqueous electrolytic solution comprises an electrolyte salt and a non-aqueous solvent comprising a chain carbonate and a cyclic carbonate selected from the group consisting of ethylene carbonate and propylene carbonate, wherein the non-aqueous electrolytic solution contains a vinylene carbonate compound of formula (I) in an amount of 0.05 to 5 wt.% and an alkyne compound of formula (VI) in an amount of 0.1 to 3 wt. %:



(I)

in which each of R<sup>1</sup> and R<sup>2</sup> independently is a hydrogen atom or an alkyl group having 1 to 4 carbon atoms:



in which each of  $R^{25}$  to  $R^{27}$  independently is a hydrogen atom, an alkyl group having 1 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms, or  $R^{26}$  and  $R^{27}$  are combined with each other to form a cycloalkylene group having 3 to 6 carbon atoms;  $x$  is 1 or 2;  $W$  is sulfinyl or oxalyl; and  $Y^6$  is an alkyl group having 1 to 12 carbon atoms, an alkenyl group having 2 to 12 carbon atoms, an alkynyl group having 2 to 12 carbon atoms, a cycloalkyl group having 3 to 6 carbon atoms, an aryl group having 6 to 12 carbon atoms, or an aralkyl group having 7 to 12 carbon atoms.

14. (Previously Presented) The lithium secondary battery of claim 13, wherein the non-aqueous electrolytic solution contains the vinylene carbonate compound in an amount of 0.1 to 3 wt.%.

15. (Previously Presented) The lithium secondary battery of claim 13, wherein each of  $R^1$  and  $R^2$  of the formula (I) is a hydrogen atom.

16. (Withdrawn) The lithium secondary battery of claim 13, wherein the non-aqueous electrolytic solution further contains an aromatic compound in an amount of 0.1 to 5 wt.%, said aromatic compound being selected from the group consisting of cyclohexylbenzene, a fluorocyclohexylbenzene compound, biphenyl, terphenyl, diphenyl ether, 2-fluorophenyl phenyl ether, 4-fluorophenyl phenyl ether, fluorobenzene, difluorobenzene,

2-fluorobiphenyl, 4-fluorobiphenyl, 2,4-difluoroanisole, tert-butylbenzene, 1,3-di-tert-butylbenzene, 1-fluoro-4-tert-butylbenzene, tert-pentylbenzene, tert-butyl biphenyl, tert-pentyl biphenyl, a partially hydrogenated o-terphenyl, a partially hydrogenated m-terphenyl and a partially hydrogenated p-terphenyl.

17. (Withdrawn) The lithium secondary battery of claim 13, wherein the non-aqueous electrolytic solution further contains a mixture in an amount of 0.1 to 5 wt.%, said mixture being selected from the group consisting of a mixture of biphenyl and cyclohexylbenzene, a mixture of cyclohexylbenzene and tert-butylbenzene, a mixture of cyclohexylbenzene and

18. (Previously Presented) The lithium secondary battery of claim 13, wherein W of formula (VI) is oxalyl, and Y<sup>6</sup> of formula (VI) is an alkynyl group having 2 to 12 carbon atoms.

19. (Previously Presented) The lithium secondary battery of claim 13, wherein the alkyne compound of formula (VI) is di(2-propynyl) oxalate.

**X. EVIDENCE APPENDIX**

A-1

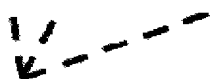
A-2

Vacant spaces formed by  
decomposition of electrolyte

B-1



B-2



Vacant spaces formed by  
decomposition of electrolyte

Declaration dated October 27, 2010 and filed November 1, 2010.

(Attached)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Koji ABE, et al. Group Art Unit: 1795  
Serial No: 10/564,852 Examiner: Laura S. Weiner  
Filed: January 17, 2006  
For: NON-AQUEOUS ELECTROLYTIC SOLUTION FOR LITHIUM  
SECONDARY BATTERY AND LITHIUM SECONDARY BATTERY  
USING THE SAME

Hon. Commissioner for Patents

DECLARATION PURSUANT TO RULE 132

I, Kazuhiro MIYOSHI, one of the above-named applicants,  
declare and state that:

1. I am familiar with the prosecution history of the  
subject patent application.
2. I now submit the following additional experimental  
data which were obtained in experimental runs carried out  
under my supervision.

Procedures for the experimental runs

The experimental procedures of Example 13 for the prepa-  
ration of a cylindrical battery given in the specification of  
the subject patent application were repeated except that the  
following modifications were made:

Run 1: A non-aqueous electrolytic solution was pre-  
pared using no vinylene carbonate and 3.2 wt.% of di(2-pro-  
pynyl) oxalate.

Run 2: A non-aqueous electrolytic solution was pre-  
pared using 10 wt.% of vinylene carbonate and 0.2 wt.% of  
di(2-propynyl) oxalate.

The initial discharging capacity and the discharge capacity retention after 300 cycle charge-discharge procedures for each cylindrical battery are set forth in the following Table.

|            | Vinylene carbonate (%) | Di(2-propynyl) oxalate (%) | Initial discharging capacity | Discharge capacity retention |
|------------|------------------------|----------------------------|------------------------------|------------------------------|
| Run 1      | 0                      | 3.2                        | 1.00                         | 66.6%                        |
| Run 2      | 10                     | 0.2                        | 1.00                         | 67.9%                        |
| Example 13 | 3                      | 0.2                        | 1.00                         | 81.7%                        |
| Com. Ex. 1 | 3                      | 0                          | 1.00                         | 64.3%                        |

Remarks: Discharge capacity retention is 300 cycle retention. Initial discharging capacity is a relative value. Data of Example 13 and Comparison Example 1 are copied from the description given in the specification.

### 3. Observation

It is my conclusion that the lithium secondary battery of our claimed invention which employs a specific combination of the positive electrode and negative electrode having a high density and a non-aqueous electrolytic solution containing a combination of a small amount of vinylene carbonate and a small amount of an alkyne compound of formula (IV), that is, Example 13, shows a prominently improved discharge capacity retention, as compared with lithium secondary battery which employs the same positive and negative electrode combination but employs the alkyne compound alone (Run 1), a combination of a relatively large amount of vinylene carbonate and a small amount of the alkyne compound (Run 2), and vinylene carbonate alone (Comp. Ex. 1).

The above-mentioned declarant declares further that all

statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that any willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Kazuhiko Miyoshi  
Kazuhiko MIYOSHI

October 27, 2010

**XI. RELATED PROCEEDINGS APPENDIX**

No decision has been issued in Appeal No. 2010-007878 with respect to Application No. 10/584,266, noted above.